totality, according to the elements we have adopted, will continue for 6m. 31s. Near St. Philip de Benguela, on the central line, we find the sun will be hidden for 4m. 23s., but the locality will hardly attract observers. It would rather appear that we must look for observations of this eclipse to the Windward Islands only. The small island of Blanquilla is close upon the central line, but the sun has of course a less altitude there than in Grenada.

The eclipse of August 7–8, 1850, one of the same series, was observed in the Sandwich Islands, the whole track of totality lying on the Pacific.

TEMPEL'S COMET, 1873, II.—According to M. Schulhof's corrected elements of this comet's orbit, which assigned a period of revolution of 5·200 years, at the last appearance in 1878, the next perihelion passage, neglecting the effect of perturbation, which can hardly be very material during the present revolution, may take place about November 19 under circumstances that will render observations difficult if they are practicable at all. Assuming the comet to be in perihelion on November 19·5 G.M.T., we should have about the following positions :—

1883.	R.A. h. m.	N.P.D. ° ′	Log. Δ.	Log. *r*.	Intensity of light.
Oct. 18·5	16 38·8	108 59	0·275	0·142	0·146
Nov. 19·5	18 33·1	114 1	0·286	0·127	0·149
Dec. 21·5	20 36·4	113 0	0·313	0·142	0·124

In 1873, under an intensity of light of 0·385, the comet was the *extremum visibile*, in a fine sky, with a 7-inch refractor.

SOLID AND LIQUID ILLUMINATING AGENTS

THE *Journal of the Society of Arts* publishes in a recent number an interesting lecture given by Mr. Leopold Field, F.C.S., on "Solid and Liquid Illuminating Agents." Mr. Field not only deals with the chemistry of these bodies, but he gives also a most interesting account of the means of lighting in use among the ancients, to which a brief reference may be made.

The earliest known method of illumination was in all probability that of the torch, formerly used largely in northern countries, and doubtless still furnishing the Lapp and the Finn with their light. The torch is cut from the pitch pine, and around it clings the exuded resin. When lighted it burns with a large red flame, producing a great deal of smoke. Used for cooking purposes a brand might get saturated with fat, so that it would burn longer without consuming its own fibre.

This, as pointed out by Mr. Field, was the old method of lighting. Substituting for their brand a piece of rope and saturating this with pitch or resin we get the modern link, connecting us on foggy days with the old modes of lighting. The work link itself, and probably also the idea, comes from the Greek λύχνος, or perhaps the Latin *luchnus* (Cicero) as the German *fackel* comes from the Greek φάκελος (faggot), a bundle of sticks—after, a torch. But our own word torch is more evidently from the Latin *tartitium*, a twisted thing, now however more properly applicable to the link. Our pine torch too is obtained from the Roman *tædæ*—slips of the tæda, or Italian pitch pine, that being the usual outdoor light of Rome; whilst *Funalia*, which Virgil tells us were used to light Dido's palace—

> "—— dependent lychni laquearibus aureis
> Incensi, et noctem flammis funalia vincunt."

is evidently from *funis*, a rope. Their composition was rather that of a finer kind of link, flambeaux, consisting of a centre of oakum, which was surrounded by alternate layers of rosin and crude beeswax, outside of all being a bleached coating of the latter. They were more costly than other kinds of torch, and giving a less smoky light were more generally employed for the illumination of halls, staircases, &c.

At what date this torch fell into disuse is a question which cannot be definitely answered, as in old times words applied to various illuminating agents, which have a very fixed and definite meaning in our day, were then interchangeable. In our translation of the Scriptures "candle" and "candlestick" are used indiscriminately with lamp, and, did we not know that candles proper and candlesticks were unknown at this period, we might infer that they were both in use. An explanation of this use of the words "candle" and "candlestick," however, is found in the fact that the Latin *candelabrum* and the Greek λυχνία, Latin *luchnuchus* (Cicero), meant "lampstand."

Again, in Matt. xxv. 1–5, where we find the parable of the Virgins, the word λυχνὸς is rendered lamp. But a study of the etymology of the words shows that they are derived from roots signifying to shine or burn—as *candela*, κανδήλα, akin to *candeo*, to shine (Persian, *kandeel*; Sans., *kan*)—λύχνος, *lucerna*, from *lux*, light (Sans. *lôk*), λάμπας, *lampas*, probably connected with *lame*, and the Hebrew *lapad*, to shine.

But although it is doubtful at what date the torch fell into disuse, it may be concluded that it was succeeded by the lamp. We find evidence of this in studying mythology. Thus Ceres, according to the old legend, sought her daughter in hell with a torch; Apuleius makes Psyche drop hot oil on Cupid from a lamp. Whether candles proper, *i.e.* wicks surrounded with wax, were known before or after lamps had come into use is doubtful. Martial (first century A.D.) speaks thus concerning the candle :—

> "Nomina *candelæ* nobis antiqua dederunt
> Non norat parcos uncta lucerna patres."—(Ep. xiv. 43).

Here, however, torch, *i.e.* *funalia*—which the old Romans in reference to its shining qualities would rather call *candela* than *funalia*—may be alluded to. In the Greek the word κανδήλα is a derivation from the Latin, not being met with until it is found in the writings of Athenæus. This author lived in the second century A.C., and in his "Deipnosophistæ" he says :—

> "ἐμοὶ δέ ποτ' ὠρολόδειπνε ἀσσαρίου κανδήλας πρίω."

By that time, however, the rushlight had come into pretty general use, and no doubt it is to this that reference is here made.

But it is from a passage in Apuleius's Metam. iv. that we get the most valuable and conclusive information on this point. A noise being heard in the middle of the night, we are told that the household come in with "tædis, lucerna, sebaceis, cereis, et ceteris," that is with torches of pine, lamps, tallow candles, and wax tapers, which therefore clearly proves that candles both of wax and tallow were in use at this date. It seems, however, that the candle was probably used by the poorer people. At all events the lamp was a mark of respectability, as in another verse of Martial (Apoph. 42) we find that an apology is made for the use of a wax light instead of a lamp :—

> "Hic tibi nocturnos præstabit cereus ignis
> Subducta est puero namque lucerna tuo."

Juvenal (iii. 287) also speaks of the "breve lumen candelæ." In the British Museum, too, there is a fragment of a large candle found in Vaison, near Orange, and said to belong to the first century A.C. Such candles were probably provided with wicks consisting of the pith of rushes rudely covered with crude wax or tallow. Candlesticks for these existed, and later on they had a spike to penetrate the butt of the candle. However, the name candelabrum was more generally applied to the pillar on which the oil lamp stood or from which it was suspended. Since no attempt was made to provide for the current of air so necessary for proper combustion, these old lamps smoked exceedingly, so much indeed that it was the duty of one of the slaves of the household to go round each morning and wipe the soot from the pictures and statues. In one case, however, at the Erectheum of the Athens Acropolis, the lamp, which was of pure gold, was provided with a flue. This was a very large lamp, requiring to be filled but once in a year. Callimachus designed it for the new temple about 400 B.C., but the smoke was found to be so great an evil in anything designed for such a purpose, that the lamp was provided with a chimney in the shape of a bronze palm-tree inverted. But however magnificent and elaborate the design, it is certain that the economy of the lamp remained stationary.

It was generally filled with olive oil and provided with a wick either of oakum, or of the dearer Carpasian flax (cotton?). Occasionally, Pliny informs us, bitumen was used to fill the lamp; Italy, in some parts, being rich in springs of that mineral and petroleum. Further east, and especially among the tribes dwelling on the shores of the Dead Sea, bitumen and naphtha were much used as illuminating agents, and for other purposes. It may be suggested that the sacred pit-fire Nepti was of this nature. The well-known Egyptologist, Mr. Basil Cooper, has suggested the following as the origin of the word naphtha, viz. *NA*, water, of *Phtha*, the Hephæstos, or Vulcan of Egypt's deities, the god of fire. This idea receives some support from the fact that the Indians who sold the first petroleum as Seneca oil, and used it largely in their rites of worship, termed it fire-water, which name is now applied to alcohol.

Herodotus (ii. 62), writing of the Lychnokaie (feast of lamps) at Sais, in Egypt, in 450 B.C., only expresses surprise at the number of the lamps, and not at the lamps themselves, so that by this time they were getting into general use. Although their

introduction as a means of illumination was very gradual and slow in Greece, yet by the end of the fifth century B.C. they were probably in general use at least among the upper ranks of society. The lamp of which Herodotus speaks, which we have mentioned above, differed in no respect from that in use at Rome, the wick (*θρυαλλίς*) being made from the woolly leaves of an indigenous plant, which was passed through the nose (*μυκτήρ*) of the lamp into the crude olive oil.

So much for the methods of lighting in use in ancient times.

It is worthy of notice how the two elements of fire and light have ever been invested with divine attributes and set up for worship. The Persian monarchs have silver fire trays borne before them into battle. The Lychnokaie, the lamp feast of the Egyptians, referred to above, has a representative in the Chinese feast of lanterns, which takes place on the 15th of the first month. Not only this, but lamp festivals have been common to all nations. The Greeks had their *λαμπαδη-δρομία*, the Romans their Lupercalia, the latter of which gave way to the institution of Pope Gelasius, Candlemas, unless it be, as some have it, that Virgilius supplanted the Pro-erpina by this festival, but in any case they are both candle festivals. We learn from Pliny's "Natural History" that the Romans used wax candles in certain rites. They lighted lamps too in honour of Prometheus, who caught fire from heaven; of Minerva, who gave them oil; and of Vulcan, the originator of lamps; they had their *fax belli*, the war torch, the *fax nuptialis*, the marriage emblem.

Lamps, too, filled with scented oil were placed on the tombs of the dead. An oracular statue of Hermes in Achaia was "worked" by lighting a lamp before him and placing a small coin at his feet. Then there is the eternal lamp of Vesta, which was tended by damsels of establi-hed reputation, the ever-lighted lamps of Mahomet's tomb, Aaron's tabernacle, and Roman Catholic churches. Again there are those lamps in tombs said to have been found burning after the lapse of centuries. Boyle made a series of experiments with the air-pump which demonstrate the absurdity of such a belief. Mr. Field, however, suggests the possibility of an asbestos wick communicating with a supply of light naphtha burning in a tomb not absolutely air-tight as a way out of the difficulty, and concludes by indorsing Lamb's opinion of our badly-illuminated forefathers, that "one can never hear mention of them without an accompanying feeling as though a palpable obscure had dimmed the face of things, and that our ancestors wandered to and fro—groping."

THE ROYAL SOCIETY OF CANADA

THE second annual meeting of the Royal Society of Canada was held at Ottawa during May 22–25. The officers who had been elected at the close of the last meeting were all present, viz. :—President, Principal Dawson, C.M.G., F.R.S.; Vice-President, Hon. P. J. O. Chauveau, LL.D.; Hon. Secretary, J. G. Bourinot, B.A.; Hon. Treasurer, J. A. Grant, M.D. Besides the members of the Society, there were present also delegates from the various local literary and scientific societies of Canada and from several British and foreign societies. Interesting inaugural addresses were delivered by His Excellency the Governor-General, who is Patron and Honorary President, by Principal Dawson, and by the Hon. Dr. Chauveau.

The report of the Council showed that a favourable answer had been received to the memorial to her Majesty the Queen, asking her gracious permission to name the Society the Royal Society of Canada; that an Act of Incorporation had accordingly been passed by the Dominion Parliament, and a sum of 1000*l.* sterling voted to assist in the payment of the expenses of publishing Transactions; and that steps had already been taken towards the formation of a national museum.

A considerable portion of the time of the Society was occupied by the discussion of a draft constitution which was submitted by the Council.

An address was presented by the Society to His Excellency the Marquis of Lorne expressive of the gratitude of the members of the Society to him for the efforts he has made during the time of his Governor-Generalship to further the interests of literature, science, and art.

Several interesting papers were read in the French and English Literature, History and Archæology Sections.

SECTION OF MATHEMATICAL, PHYSICAL, AND CHEMICAL SCIENCES

The following papers were read in this Section, which was presided over by T. Sterry Hunt, F.R.S. :—(1) Prof. J. G. MacGregor, D.Sc., Halifax, N.S., on "Experiments showing that the Polarisation of Electrodes is independent of their Difference of Potential." The same current was passed through two electrolytic cells (in series) containing dilute sulphuric acid and platinum electrodes. The cells had the same section but differed in length. The electrodes, therefore, differed in potential during the passage of the current, while the current had in both cells the same density. Curves showing the variation with time of the electromotive force of the respective cells after the cessation of the polarising current were drawn, and were found to coincide. The measurements of difference of potential were made by means of the quadrant electrometer. (2) Prof. B. J. Harrington, Ph.D., Montreal, on "An Analysis of two Minerals recently discovered in Canada—Meneghinite and Tennantite." During the discussion of this paper Dr. J. H. Ellis, of Toronto, exhibited a specimen of tellurium which he had extracted from the gold ores of Lake Superior. (3) C. Baillargè, C.E., Quebec, on "Hints to Young Geometers." (4) Prof. E. Haanel, Ph.D., Cobourg, on "Hydriodic Acid as a Blowpipe Reagent." The author had already proposed to use hydriodic acid as a blowpipe reagent in the case of four metals. This paper described the results of experiments made to extend its employment to others. Instead of charcoal he used flat plates of plaster of Paris, and in the case of all the metals which had been at the author's disposal, the blowpipe brought out on these plates easily distinguishable characteristic colours. Owing to the difference of volatility (chiefly) of the products of decomposition, three or four metals could be detected as present in a mineral by a single test, so distinctive are the colours of the iodides and other compounds formed. Prof. Haanel gave most successful experimental illustrations of the new method before the Section. (5) Prof. Coleman, Cobourg, on "The Spectra of certain of the Characteristic Colours of Prof. Haanel's Method of Blowpipe Analysis." (6) Prof. N. F. Dupuis, A.M., Kingston, on "The Construction of a Clock intended to show both Mean and Sidereal Time." The author had constructed the clock described; it gave a much closer approximation to accuracy than any such instrument hitherto proposed. (7) E. Deville, C.E., Ottawa, on "The Measurement of Terrestrial Distances by Astronomical Observations." The author deduced expressions for such distances in terms of differences of latitude and of azimuth respectively, and showed the influence of various sources of error in the use of these expressions. (8) T. McFarlane, M.E., Montreal, on "The Reduction of Sulphate of Soda by Carbon." (9) C. Baillargé, C.E., Quebec, on "Simplified Solutions of two of the more difficult cases in Hydrographic Surveying," and on "The Measurement of Surveys by Spherical Triangles and Polygons on a Sphere of any Radius." (10) Sandford Fleming, C.M.G., Ottawa, on "The Adoption of a Universal Meridian for the Regulation of Time." The author showed that the proposal he had made some years ago was meeting with a favourable reception. In connection with this paper the Section adopted a resolution urging the Society to memorialise the Governor-General, asking that he use his influence to induce the Imperial Government to grant representation to Canada at the International Conference on Standard Time to be held at the invitation of the President of the United States. (11) Reports by Prof. A. Johnson, LL.D., Montreal, and C. H. Carpmall, M.A., Toronto, Superintendent of the Meteorological Service, on "The Preparations made for the Observation of the Transit of Venus in Canada, and on the Observations which had been made." (12) Dr. J. H. Ellis, Toronto, on "A Remarkable Sulphur Spring near Port Stanley," and on "A Method by which the Tannin Determination of Löwenthal might be utilised for the Detection of Impurities or Adulterations in Spices." (13) F. W. Gisborne, Esq., Ottawa, on "Recent Improvements in Practical Telegraphy." (14) T. McFarlane, M.E., Montreal, on "The Decomposition of Zinc Sulphate by Common Salt." (15) T. Sterry Hunt, F.R.S., on "The Mechanical Transfer of Matter in the process of Segregation."

Prof. Cherriman, M.A., Ottawa, was elected president, Mr. T. McFarlane vice-president, and Prof. A. Johnson secretary of the Section for the next year.

SECTION OF GEOLOGICAL AND BIOLOGICAL SCIENCES

A. R. C. Selwyn, F.R.S., Director of the Geological Survey of Canada, presided over this section. The following papers were read :—(1) Dr. Selwyn, on "Notes on the Geology of Lake Superior." The points insisted on were: the conformity of the Laurentian and Huronian divisions of the older crystalline rocks; the Lower Cambrian age of the upper copper-bearing